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A Framework for Reconstructing the Complete Evolutionary History of Low-Mass X-ray Binaries CHARLES KIMBALL, Center for Interdisciplinary Exploration and Research in Astrophysics (CIERA) and Department of Physics and Astronomy Northwestern University, TASSOS FRAGOS, MADS SORENSEN, Dark Cosmology Centre, Niels Bohr Institute, University of Copenhagen, VICKY KALOGERA, APRAJITA HAJELA, MICHAEL ZEVIN, SLOBODAN MENTOVIC, Center for Interdisciplinary Exploration and Research in Astrophysics (CIERA) and Department of Physics and Astronomy Northwestern University — We present a methodology for reconstructing the complete evolutionary histories of low-mass x-ray binaries (LMXBs), from Zero Age Main Sequence through Roche-lobe overflow, given observational constraints. Using a patchwork of parametric binary evolution software, model-independent supernova calculations, numerical integration of equations governing tidal evolution, and detailed mass transfer simulations, we obtain constraints on system parameters at birth, the moments just before and just after the core-collapse and supernova of the LMXBs black hole progenitor, and at the onset of Roche-lobe overflow. In anticipation of the wealth of proper motion data for galactic LMXBs to be provided by upcoming Gaia catalogues, we combine the results with simulated trajectories of the system through the galactic potential to find probable birth sites of the LMXBs black hole, allowing us to place constraints on the natal kick imparted at supernova. As an example, we apply this framework to GRS 1915+105 and conclude that it did not receive a natal kick in excess of ~ 200 km/s.

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